

# WATO EX-65

## Anesthesia System

### Physical Specifications

#### Dimensions and Weight

Height	1370 mm
Width	780 mm (not including breathing system) 945 mm (including breathing system)
Depth	690 mm
Weight	<145 kg (without vaporizers and cylinders)

#### Top Shelf

Weight limit	30 kg
Width	305 mm
Length	545 mm

#### Work Surface

Height	850 mm
Area	1635 cm <sup>2</sup>

#### Drawer (3Xdrawers, Internal Dimension)

Height	130 mm
Width	415 mm
Depth	320 mm

#### Bag Arm

Height	1150 mm
Length	312 mm
Connection	ISO 22mm OD, 15mm ID

#### Casters

Diameter	125 mm
Brakes	Center brake system with Lock / Unlock icons

### Ventilator Specifications

#### Modes of Ventilation

Manual/Spontaneous Ventilation/Bypass  
Volume Control Ventilation (VCV) with PLV function  
Pressure Control Ventilation (PCV) with/without volume guarantee (VG)  
Synchronized Intermittent Mandatory Ventilation (SIMV-Volume Controlled and SIMV-Pressure Controlled)  
Pressure Support Ventilation (PS) with apnea backup  
Synchronized Intermittent Mandatory Ventilation Volume Guarantee (SIMV-VG)  
Continuous Positive Airway Pressure/Pressure Support Ventilation (CPAP/PS)

#### Compensation

Circuit gas leakage compensation and automatic compliance compensation

#### Ventilation Parameters Range

Patient Size	Adult, Pediatric, Neonate
Tidal volume	10~1500 mL (Volume Mode) 5~1500 mL (Pressure Mode)
Pinsp	5~80 cmH <sub>2</sub> O
Plimit	10~100 cmH <sub>2</sub> O
ΔPsupp	3~60 cmH <sub>2</sub> O 0, 3~60 cmH <sub>2</sub> O (CPAP/PS)
Rate	2~100 bpm
I:E	4:1 - 1:8
Inspiratory pause (Tip:Ti)	OFF, 5% - 60%
Inspiratory time (Tinsp)	0.2 - 10.0 s
Trigger window	5% - 90%
Flow trigger	0.2 ~ 15 L/min
Pressure trigger	-20~ -1 cmH <sub>2</sub> O
Expiration termination level	5% - 80%
Minimum Rate	2 - 60 bpm



Tslope	0.0 - 2.0 s
Apnea I: E	4:1~1:8
ΔPapnea	3 - 60 cmH <sub>2</sub> O
<b>Positive End Expiratory Pressure (PEEP)</b>	
Type	Integrated, electronic controlled
Range	OFF, 3~30 cmH <sub>2</sub> O

#### Ventilator Performance

Driving pressure	280 kPa to 600 kPa
Peak gas flow	120 L/min + Fresh Gas Flow

#### Monitoring Parameters

Minute volume	0 ~ 100 L/min
Tidal volume	0~3000 ml
Inspired oxygen (FiO <sub>2</sub> )	18% ~ 100%
Airway pressure	-20 ~ 120 cmH <sub>2</sub> O
I:E	50:1 ~ 1:50
Rate	0~120 bpm
PEEP	0 ~ 70 cmH <sub>2</sub> O
Resistance (R)	0 ~ 600 cmH <sub>2</sub> O/(L/s)
Compliance (C)	0 ~ 300 ml/cmH <sub>2</sub> O
Elasticity (E)	0.003 to 10 hPa/mL(cmH <sub>2</sub> O/mL)

#### Control Accuracy

Volume delivery	5 mL to 60 mL: ±10 mL 60 mL to 210 mL: ±15 mL 210 mL to 1500 mL: ± 7% of the set value
Pressure	Pinsp, Plimit, ΔPsupp, ΔPapnea ± 2.5 cmH <sub>2</sub> O or ± 7% of the set value, whichever is greater
PEEP	OFF: ± 3.0 cmH <sub>2</sub> O 3 to 30 cmH <sub>2</sub> O: ± 2.0 cmH <sub>2</sub> O, or ± 8% of the set value, whichever is greater
Rate	± 1bpm or ± 10% of the set value, whichever is greater
I:E	2:1 to 1:4: ± 10% of the set value Other range: ± 25% of the set value
Tip:Ti	± 8%
Tinsp	± 0.2s
Trigger Window	± 10%
Flow Trigger	± 1L/min
Pressure Trigger	± 2cmH <sub>2</sub> O
Exp%	± 10%

#### Monitoring Accuracy

Volume monitoring	0 to 60 mL: ± 10 mL 60 to 210 mL: ± 15 mL 210 to 3000 mL: ± 7% of the real reading
Pressure monitoring	± 2.0 cmH <sub>2</sub> O or ± 4% of the real reading, whichever is greater
Rate	± 1bpm or ± 5% of the real reading, whichever is greater

I:E	2:1 to 1:4: ± 10% of the reading Other range: no defined.
MV	± 0.1L/min or ± 8% of the real reading, whichever is greater
O2 concentration	± (2.5% of volume percentage + 2.5% of gas concentration)

### Trend Graph

Continuous trend information with time discrete events for the latest 48 hours

### Trend Table

Continuous trend information together with time discrete events for the latest 48 hours

### Alarm Log Book

500 events storage, first in first out

### Alarm setting

Tidal volume	Low: 0 ~ 1595 ml High: 5 ~ 1600 ml
Minute volume	Low: 0 ~ 99 L/min High: 0.2 ~ 100 L/min
Inspired oxygen	Low: 18% ~ 98% High: OFF, 20% ~ 100%
Apnea alarm	VT <sub>e</sub> < 10ml measured in 20s Paw < (PEEP + 3) cmH <sub>2</sub> O in 20s
Airway pressure low	0 ~ 98 cmH <sub>2</sub> O
Airway pressure high	2 ~ 100 cmH <sub>2</sub> O
Sustained airway pressure alarm:	15s
Subatmospheric pressure alarm:	Paw < -10 cmH <sub>2</sub> O
Alarm silence countdown timer:	120 to 0 seconds

### Lung Recruitment Tool

Maneuver	Multi-Step and One-Step Recruitment
One-Step Recruitment	Pressure Hold: 20 to 60 cmH <sub>2</sub> O Hold Time: 10 to 40s PEEP on Exit: Off, 3 to 30 cmH <sub>2</sub> O
Multi-Step Recruitment	Increasing PEEP progressively (with a maximum of 7 stages)

### Ventilator Components

#### Flow Sensor

Type	Variable orifice flow sensor
Location	Inspiratory and expiratory port

#### Oxygen Sensor

Type	Galvanic fuel cell
FiO <sub>2</sub> displayed	18% to 100%
Accuracy	± (volume fraction of 2.5 % + 2.5 % gas level)
Response Time	≤ 20 seconds

#### Ventilator Screen

Display type	Color capacitive touch screen
Display size	15 inch
Pixel format	1024 x 768
Brightness	Adjustable
Screen display	configurable
Display parameters	All setting and alarm parameters (including Breath rate, I/E ratio, Tidal volume, Minute volume, PEEP, MEAN, PEAK, PLAT, and O <sub>2</sub> concentration, EtCO <sub>2</sub> , N <sub>2</sub> O, Anesthesia gas concentration, BIS)
Display waveforms	P-T, F-T, V-T, CO <sub>2</sub> , BIS, O <sub>2</sub> , Anesthetic gas, N <sub>2</sub> O
Spirometry loops	P-V, F-V and F-P
Timer	On screen timer

#### Communication Ports

One RS-232C connector and one DB9 connector  
Ethernet (RJ-45)  
USB  
VGA

### Vaporizers

Vaporizer	Mindray V60 Anesthetic Vaporizer or Penlon Sigma Delta Anesthetic Vaporizer
Support agents	Halothane, Enflurane, Isoflurane, Sevoflurane
Position	MAX.2
Mounting mode	Selectatec®, with interlocking function Plug-in®, with interlocking function

### Modules

#### Anesthesia Gas (AG) Module

Monitor gases	CO <sub>2</sub> , N <sub>2</sub> O, Halothane, Enflurane, Isoflurane, Sevoflurane, Desflurane, MAC, Paramagnetic O <sub>2</sub> (optional)
Warm-up time	45 s (ISO accuracy mode) 10min (full accuracy mode)
Pump rate	Adu/Ped: 150, 180, 200 ml/min Neo: 100, 110, 120 ml/min
Range	CO <sub>2</sub> : 0% ~ 10% Des: 0% ~ 18 % Sev: 0% ~ 8% Enf, Iso, Hal: 0% ~ 5% O <sub>2</sub> /N <sub>2</sub> O: 0% ~ 100%

#### Carbon Dioxide (CO<sub>2</sub>) Modules

Method	Infrared absorption
Module type	Mindray side-stream Capnostat mainstream Oridion micro-stream (optional)
Work mode	Standby or measurement
Displayed numerics	EtCO <sub>2</sub> , FiCO <sub>2</sub>
Waveform	Capnography

#### Side-Stream Carbon Dioxide (CO<sub>2</sub>) Module

Measurement range	0 ~ 152 mmHg
Accuracy	± 2 mmHg (0 ~ 40 mmHg) ± 5% of the real reading (41 ~ 76 mmHg) ± 10% of the real reading (77 ~ 152 mmHg)
Resolution	1 mmHg
Pump rate	Neonatal: 100 mL/min or 120 mL/min Adult/children: 120 mL/min or 150 mL/min
Warming-up time	< 1 min, enter the ISO accuracy mode After 1 min, enters the full accuracy mode
Response time	< 5 s@100 mL/min < 5 s@120 mL/min Measured by using neonatal watertrap and 2.5 m neonatal sampling line < 6.5 s@120 mL/min < 6 s@150 mL/min Measured by using adult watertrap and 2.5 m adult sampling line

#### Mainstream CO<sub>2</sub> Module

Measurement range	0 ~ 150 mmHg
Accuracy	± 2 mmHg (0 ~ 40 mmHg) ± 5% of the reading (41 ~ 70 mmHg) ± 8% of the reading (71 ~ 100 mmHg) ± 10% of the reading (101 ~ 150 mmHg)
Resolution	1 mmHg
Response time	< 2 s
Alarm limit	EtCO <sub>2</sub> High: OFF, 2 ~ 150 mmHg EtCO <sub>2</sub> Low: OFF, 0 ~ 148 mmHg FiCO <sub>2</sub> High: OFF, 1 ~ 150 mmHg

#### Micro-stream CO<sub>2</sub> Module

Measurement range	0 ~ 99 mmHg
Accuracy	0 ~ 38 mmHg: ± 2 mmHg 39 ~ 99 mmHg: ± (5 % of the reading + 0.08 % of (the reading minus 38 mmHg))

Sampling rate	50 ml/min
Sampling accuracy	-7.5 ml/min ~ + 15 ml/min
Initialization time	30s
Response time	≤ 2.9s
Rising time	≤ 190 ms
Alarm range	EtCO <sub>2</sub> High: OFF, 2 ~ 99 mmHg EtCO <sub>2</sub> Low: OFF, 0 ~ 97 mmHg FiCO <sub>2</sub> High: OFF, 1 ~ 99 mmHg

#### BIS Module

Measured parameters	EEG
BIS/BIS L, BIS R	0 ~ 100
Sweep speed	6.25 mm/s, 12.5 mm/s, 25 mm/s or 50 mm/s
Alarm limit	BIS high: 2 ~ 100 BIS low: 0 ~ 98
Calculated parameters	SQI/SQI L, SQI R; EMG/EMG L, EMG R; SR/SR L, SR R; SEF/SEF L, SEF R; TP/TP L, TP R; BC/BC L, BC R; sBIS L, sBIS R; sEMG L, sEMG R; ASYM

#### Agent Consumption Calculation

Calculation range	0 to 3000 ml
Accuracy	± 2 mL, or ± 25% of the real reading, whichever is larger

#### Electrical Specifications

##### Current Leakage

100 ~ 240V	< 500 µA
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##### Power and Battery Backup

Power input	220-240 V, 50/60 Hz, 6A 100-120 V, 50/60 Hz, 7A 100-240 V, 50/60 Hz, 7A
Auxiliary electrical outlets	Up to 4 outlets (3A for each, total 5A)
Battery backup	90 minutes in case of one battery or 240 minutes in case of two batteries (powered by new fully-charged batteries with 25°C ambient temperature)
Battery type	Build-in Li-ion battery, 10.95 VDC, 4500 mAh
Safety feature	In case of electricity and battery failure, manual ventilation, gas delivery and agent delivery are possible

#### Pneumatic Specifications

##### ACGO (Auxiliary Common Gas Outlet, Integrated)

Connector	ISO 22 mm OD and 15 mm ID
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##### Pipeline Supply

Gas type	O <sub>2</sub> , N <sub>2</sub> O and Air
Pipeline input range	280 to 600 kPa
Pipeline connections	DISS or NIST

##### Pipeline Supply Pressure Gauges

Display type	Mechanical
Ranges	0 to 1000kPa
Accuracy	± (4% of the full scale reading + 8% of the actual reading)

##### Cylinder Supply

Cylinder Supply	E Cylinder (American style or UK style)
O <sub>2</sub> Input Range	6.9 to 20 MPa
N <sub>2</sub> O Input Range	4.2 to 6 MPa
Air Input Range	6.9 to 20 MPa
Cylinder Connections	Pin-Index Safety System (PISS)
Yoke Configuration	O <sub>2</sub> , N <sub>2</sub> O, Air

##### Cylinder Supply Pressure Gauges

Display type	Mechanical
Air Range	0 to 25 MPa
O <sub>2</sub> Range	0 to 25 MPa
N <sub>2</sub> O Range	0 to 10 MPa
Accuracy	± (4% of the full scale reading+8% of the actual reading)

#### O<sub>2</sub> Controls

Method	N <sub>2</sub> O shut off with loss of O <sub>2</sub> pressure
Supply failure alarm	≤ 220.6 kPa ± 34.2kPa
O <sub>2</sub> Flush	25 ~ 75 L/min

#### O<sub>2</sub>-N<sub>2</sub>O Link system

Type	Mechanical
Range	O <sub>2</sub> concentration not lower than 25%

#### Auxiliary O<sub>2</sub> Flowmeter

Range	0 ~ 15 L/min
Indicator	Flow tube

#### Electronic Flow Meters

O <sub>2</sub> flow range	0 to 15 L/min
Air flow range	0 to 15 L/min
N <sub>2</sub> O flow range	0 to 10 L/min
Accuracy	between -10% and +10% of the indicated value (under 20°C and 101.3 kPa, for flow between 10% and 100% of full scale)

#### Optimizer

Only available when AG or CO<sub>2</sub> Module is loaded

#### Environmental Specifications

##### Operating

Temperature	10 ~ 40°C
Relative humidity	15% ~ 95% (noncondensing)
Barometric (Kpa)	70 ~ 106 kPa

##### Storage

Temperature	-20 ~ 60°C for main unit, -20 ~ 50°C for O <sub>2</sub> sensor
Relative humidity	10% ~ 95% (noncondensing)
Barometric	50 ~ 106 kPa

#### Electromagnetic Compatibility

Immunity	Complies with all requirements of IEC 60601-1-2
Emissions	Complies with all requirements of IEC 60601-1-2

#### Breathing System Specification

##### Breathing system volume (Pre-pak)

Automatic ventilation	2850 ml
Manual ventilation	1800 ml

##### Breathing system volume (Non Pre-pak)

Automatic ventilation	2600 ml
Manual ventilation	1800 ml

#### System Components

Carbon dioxide absorbent canister	Absorbent capacity: 1500 mL
Integrated expiratory limb water trap	Capacity: 6 mL

#### Breathing Circuit Parameters

System leakage	≤ 60 mL/min at 3 kPa
Compliance	≤4 mL/100Pa (Manual mode) Automatically compensates for compression losses within the breathing circuit in mechanical mode
Expiration resistance	< 6.0 cm H <sub>2</sub> O @60 L/min
Inspiration resistance	< 6.0 cm H <sub>2</sub> O @60 L/min

#### System Pressure Gauge

Range	-20 ~ 100 cmH <sub>2</sub> O
Accuracy	± (2% of the full scale reading + 4% of the actual reading)

#### Ports and Connectors

Exhalation	22 mm OD / 15 mm ID conical
Inhalation	22 mm OD /15 mm ID conical
Manual bag port	22 mm OD /15 mm ID conical

#### Bag-to-Ventilator Switch

Type	Bi-stable
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Control	Switch between manual and mechanical ventilation
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#### **Integrated Adjustable Pressure Limiting (APL) Valve**

Range	SP, 5 ~ 70 cmH <sub>2</sub> O
Tactile knob indication at above 30 cmH <sub>2</sub> O	
Accuracy	± 3 cmH <sub>2</sub> O or ± 15% of the setting value, which is greater, but is not more than + 10 cmH <sub>2</sub> O

#### **Anesthetic Gas Scavenging System (AGSS)**

Size (H x W x D)	430 x 132 x 114 mm
Type of disposal system	Active: High-flow or Low-flow Passive
Applicable standard	ISO 80601-2-13
Pump rate	75 ~ 105 L/min (High-flow) 25 ~ 50 L/min (Low-flow)

Pressure relief device: Pressure compensation opening to the air  
State indication of the disposal system: The float falls below the "MIN" mark on the sight glass when the disposal system does not work or the pump rate is lower than 25 L/min (Low-flow) or 75 L/min (high-flow).  
Connector of the disposal system: ISO 9170-2

#### **Materials**

All materials in contact with exhaled patient gases are autoclavable, except flow sensors (being not capable of being autoclaved), O<sub>2</sub> sensor, and mechanical pressure gauge.  
All materials in contact with patient gas are latex free.

#### **Suction Device**

##### **Venturi Suction Regulator**

Gas source	Air, from system gas source
Minimum flow	20 L/min
Maximum vacuum	≥72 kPa at supply gas pressure of 280 kPa; ≥73 kPa at supply gas pressure of 600 kPa

##### **Continuous Suction Regulator**

Supply	Negative Pressure Suction
Maximum vacuum	517.5 mmHg to 540 mmHg (69 kPa to 72 kPa) with external vacuum applied of 540 mmHg and 40 L/min free flow
Maximum flow	39 L/min to 40 L/min with external vacuum applied of 540mmHg and 40 L/min free flow
Minimum flow	20 L/min

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Please contact your local Mindray sales representative for the most current information.

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